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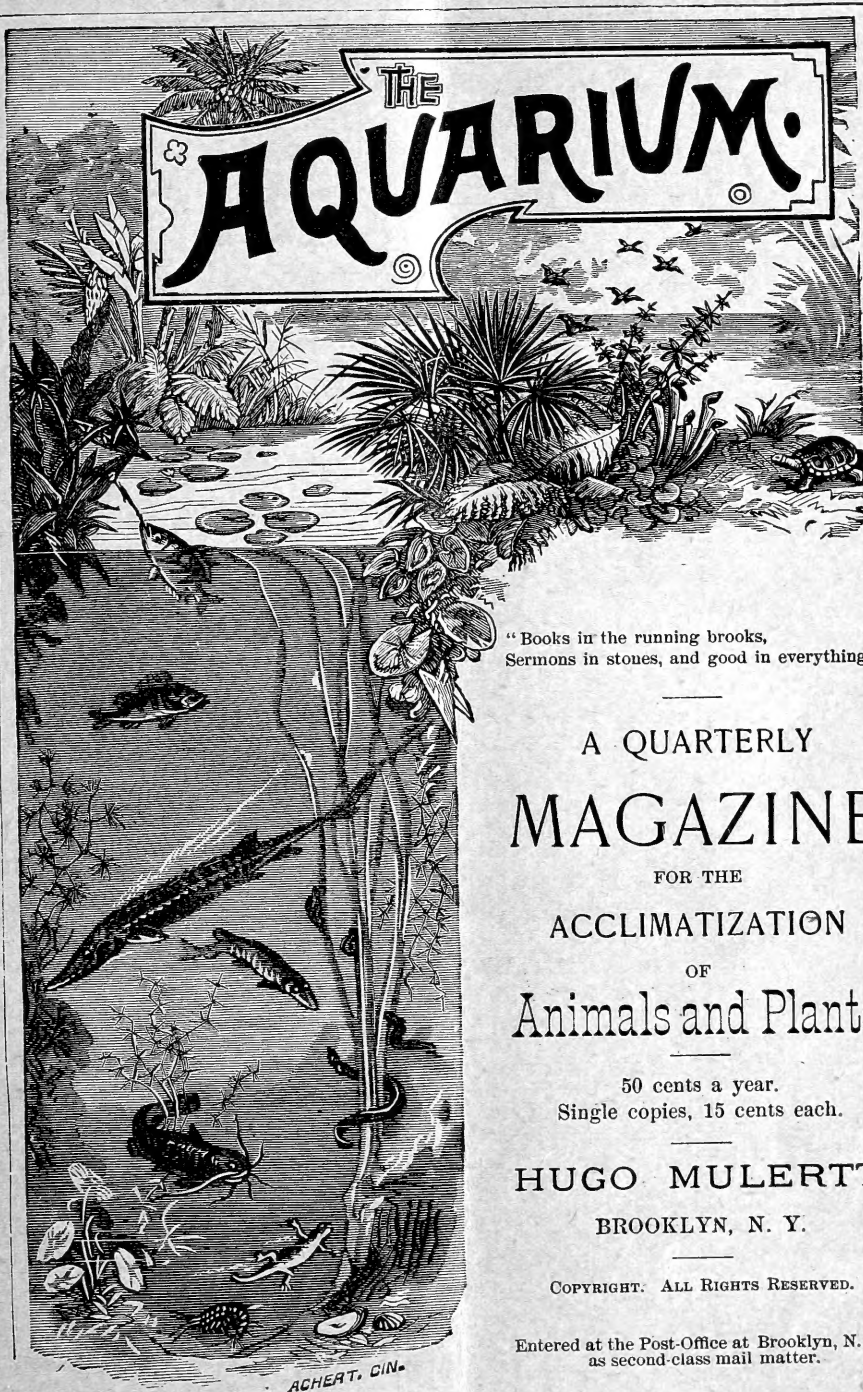
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U. S. NATIONAL MUSEUM

Vol. III.

JULY, 1894.

No. 32



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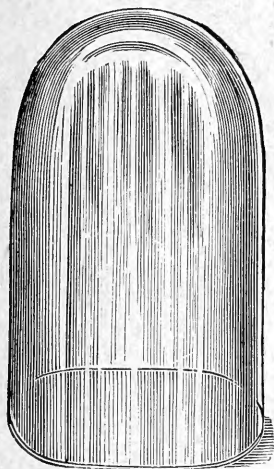
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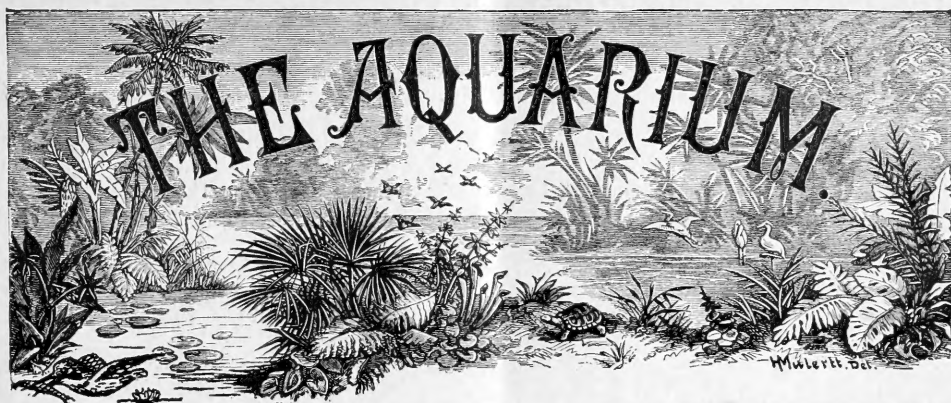
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DENOMINATIVE CHARACTER-
ISTICS OF FRESH WATER
FISHES.

VI.

THE SUCKERS.

(*Catostomidae*.)

These fish, though forming a distinct family, are very closely related to the carp-family, and with two or three exceptions that are found in China and Japan, are exclusively of American nativity.

The head is naked; the mouth, which is underneath, is toothless. The lips are fleshy, extremely protractive, and when fully produced form a tube; through this the fish "sucks" its food, hence the name for the family. The mouth is not supplied with barbules. The scales upon the body are of uniform size. The dorsal fin is short in some species, while in others it extends from the middle of the body almost to the tail, but in all cases it consists of soft rays. The caudal fin (tail) is slightly forked. The air bladder is divided in two, and in some species three parts. Their spawning season is in the spring of the year.

THE WHITE SUCKER.

(*Catostomus teres*.)

This is the most common species, being found in the creeks, rivers and lakes, all over the United States, though it is nowhere esteemed as a food fish, the flesh being without flavor and literally filled with little bones. The body is long and cylindrical; the color on the back is olivaceous, silvery on the sides and belly. The coloring and size of the fish varies in different localities, attaining in some instances a length of 18 inches.

THE STONE-LUGGER.

(*Hypentelium nigricans*.)

This species is also known as the Brown, Mud or Spotted Sucker. The head is rather large and blunt, the eyes small and are set very high up and far back. The body is long and carries very large fins. The back and sides are beautifully marbled, or blotched, with different shades of brown, producing an interesting effect in contrast with the white belly. It grows to a length of about twelve inches, and frequents swiftly running creeks, where it is generally found under the stones. The flesh is soft, the bones too small and numer-

ous to make it desirable for the table. It is rather a pretty fish and does splendidly in the aquarium, where it can be seen sucking the low vegetation from the glass sides and stones, etc., this habit making it a good scavenger.

THE RED-HORSE, OR MULLET.

(*Moxostoma duquesnei*.)

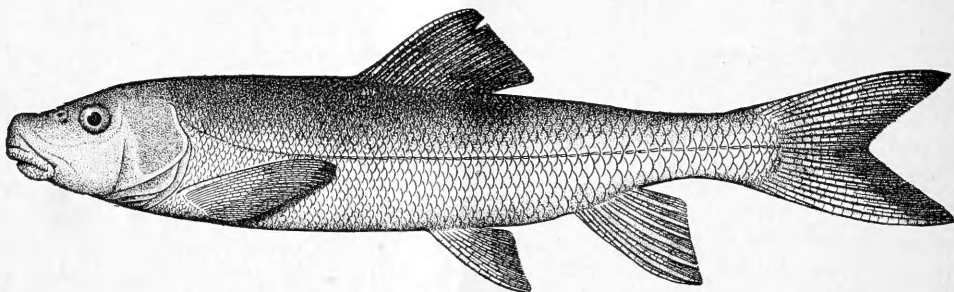
The body is long and compressed upon the sides, very much carp-like in appearance. The color on the back is olive, the sides bright silvery, showing reflections of red and green; the lower fins are red. The markets abound with this species of fish, but it is only regarded as a cheap food.

side, gives the forehead a very odd appearance. The dorsal fin is long, high in front, and towards the caudal fin it is low, reaching, when the first rays are depressed, almost to the tail. The fish is a native of Lake Erie and the Ohio river; in the former place it is caught in large quantities, split, salted, and sold as lake shad.

THE BUFFALO FISH.

(*Bubalichtys cyanellus*.)

The body is an oblong oval, compressed upon the sides. The scales with which it is covered are of a bluish, silvery color. The head is of medium size; the mouth small. The dorsal fin



THE RED HORSE.

THE GOLDEN MULLET.

(*M. aureolum*.)

This species is a native of the Great Lakes, and is also called the Lake Red-horse. The body is shaped like the former, but grows to a larger size, generally weighing about 20 pounds. The color is a yellowish brown; the abdominal fins are red.

THE SPEAR-FISH.

(*Carpiodes velifer*.)

It is also known as the Sailback, Quillback, and Carpsucker. The body is like that of the carp and covered with silvery scales. The head is small, the mouth, situated on the extreme lower

is long and consists of twenty-three or twenty-four rays. The buffalo is the largest representative of the carp-like fishes in this country, perhaps in the world. Specimens weighing some 75 or 80 pounds have been caught in the Ohio river, and those from 30 to 40 pounds in weight are often taken now. The German carp has been frequently compared with the buffalo, but the only resemblance is in the shape and coat of scales.

The flesh of the buffalo fish is not equal to that of the genuine carp in flavor, though the buffalo of from six to eight pounds weight is by no means to be despised as a table fish.

(To be Continued.)

WHERE SNAILS ABOUND.

For fresh water species various resorts are to be searched. Go to the torrents with rocky bottoms for the paludinas and periwinkles (*Melania*); to quiet brooks for physas and coilshells; to stagnant pools in the wet ooze and the reeking swamps for limneas. We know no better place in the world for pond snails than the tule marshes of the Pacific slope, where hundreds of the great graceful *Limnea stagnalis* lie among the rotting vegetation, or float upside down at the surface of the still water. But some of the fresh water mollusks remain most of the time at the bottom, coming to the surface only to breathe now and then, and to get their shells it is necessary to use a sieve-bottomed dipper, or some sort of dredge. When the water becomes low they bury themselves in the mud; it is therefore always profitable, late in the summer, to rake out the bottom of mud-holes where the water has entirely disappeared. Another plan is to gently pull up the water weeds by the roots and cleanse them in a basin of water. You will thus secure many very small species. Experience will quickly teach the collector where he may expect to find this and that kind, and that some caution and much sharpness of observation are necessary, since some species by their naturally dead tints, and others by a coating of mud, assimilate themselves so nearly to their surroundings as easily to be overlooked.

The shell is increased rapidly for the first two or three years, and the delicate lines of increment, parallel with the outlines of the aperture, are readily visible on all the larger specimens. Various other signs indicate youth or adult age in the shell.

Mollusks prosper best, *coeteris paribus*, in a broken landscape, with plenty of lime in the soil. The reason, no doubt, why the West India Islands, the Cumberland Mountains and similar regions are so peculiarly rich in shells of every sort, is that a ravine-cut surface and a wide area of limestone rocks characterize those districts; on the other hand, it is not surprising that we found nine-tenths of the Rocky Mountain species to be minute, since the geology is represented by sandstone and volcanic rocks. Hot springs are very likely to be inhabited by mollusks, even when the temperature exceeds 100 degrees Fahrenheit, and the waters are very strongly impregnated with mineral salts.

Snails are mainly vegetarians, and all their mouth parts and digestive organs are fitted for this diet. Just below the lower tentacles is the mouth, having on the upper lip a crescent-shaped jaw of horny texture, with a knife-like, or sometimes saw-like, cutting edge. The lower lip has nothing of this kind, but in precisely the same attitude as our tongue is arranged a lingual membrane, long, narrow and cartilaginous, which may be brought up against the cutting edge of the upper jaw. This "tongue" is studded with rows of infinitesimal silicious "teeth," eleven thousand of which are possessed by our common white-lipped helix, although its ribbon is not a quarter of an inch long. All these sharp denticles point backward so that the tongue acts not only as a rasp, but takes a firm hold upon the food. On holding the more transparent snails up to the light it is easy to see how they eat, and you can hear a nipping noise as the semi-circular piece is bitten out of the leaf. Their voracity often causes immense devastation, particularly in

England, where the great gray slugs will ruin a garden in one night, if the gardener is not daily on the watch. Our own strawberries sometimes suffer, but a border of sawdust, sand or ashes around the bed is an adequate protection in dry weather. In trying to cross it the marauders become so entangled in the particles adhering to their slimy bodies, that they exhaust themselves in the attempt to get free. They also are very fond of fungi, including many poisonous kinds.

At the first hint of frost our snail feels the approach of a resistless lassitude, and, creeping under some mouldering log or half-buried boulder, it attaches itself, aperture upward, by exuding a little glue, and settles itself for a season of hibernating sleep. Withdrawing into the shell, the animal throws across the aperture a film of slimy mucus, which hardens as tight as a miniature drum-head. As the weather becomes colder, the creature draws itself a little farther in, and makes another "epiphragm," and so on until often five or six protect the animal sleeping snugly coiled in the deepest recesses of his domicile.

This state of torpidity is so profound that all the ordinary functions of the body cease—respiration being so entirely suspended that chemical tests are said to discover no change from its original purity in the air within the epiphragm. Thus the snail can pass without exhaustion the long, cold months of the North, when it would be impossible for it to secure its customary food. The reviving sun of spring only interrupts this deep slumber, and the period of awakening is therefore delayed with the season, according to the varying natures of the different species. At any time, however, an artificial

raising of the temperature breaks the torpor, the warmth of the hand being enough to set the heart beating. Extreme drouth also will cause snails to seal their doors hermetically, without even hanging a card basket outside. This is to shut off the evaporation of their bodily moisture, and happens in midsummer, hence it is termed aestivation. Certain slugs (*Testacellidae*), which have no shells, are able to protect themselves under the same circumstances by a gelatinous appendage of the mantle, which, in case of sudden change of temperature can be extended like an outer mantle, so to speak, from its place of storage, under the "buckler," and having wrapped themselves, they burrow in the soil.

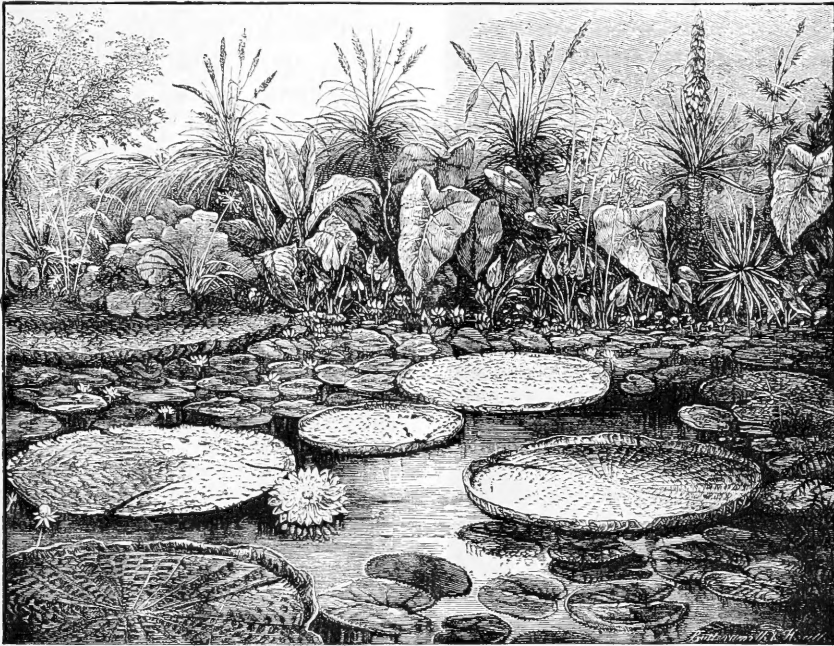
AQUATIC PLANTS AT HOME.

In the Amazon region, which comprises such vast extents of water, there must necessarily be a large number of aquatic plants, and some of these are very ornamental. In voyaging by canoe through miles upon miles of the water ways which thread all of the "*varzea*," for so the land subject to overflow with the annual rise of the river is called, one finds many curious species. In the main Amazon there are few, though at times one sees bays full of the pretty "*Eichornia speciosa*," for the banks are constantly changing, the current is rapid and there is little opportunity for any permanent growth to establish itself. But the "*varzea*" is full of lakes, many of which are very large, and even where the banks of the Amazon are high, there are usually some miles back from the river clear water lakes. All of these lakes communicate with the main river, either directly or indirectly by streams connecting one with another.

These streams are called "*igaripes*;" often they are broad and generally very deep and navigable for canoes. When the river is falling the water runs from the lakes into the Amazon; when the water rises these "*igaripes*" run up stream. One can easily lose himself in these intricate water ways. This "*varzea*" region is not permanently habitable and only serves for pasturage,

park; immense trees scattered over it; the ground covered with short grass; no undergrowth; clear water lakes here and there; the whole forming a most charming landscape.

It is in the lakes and "*igaripes*" that water plants abound, though in the main river the voyager often finds plenty floating on their way to the distant ocean, they having been torn from



VICTORIA REGIA.

where not wooded, or for summer plantations. It often is covered, especially on the upper river, with gigantic Bamboos, sometimes with a very tall grass, and if low enough to be permanently wet, is an inextricable tangle of vines, prickly Palms, generally species of *Bactris*, and stinging grasses. Where it is high and only flooded for a short time, it forms in summer a very attractive region. We have seen stretches of thousands of acres which looked like a well kept

their homes and borne from the lakes by the current, dislodged by a falling bank, or uprooted by a rise of the river. In low water the shallow bays of the Amazon grow up with grass, which, with long floating root stocks, covers vast areas. As the river rises these masses are torn away and go floating down the river. We have seen them at least half an acre in area, and at times the whole river is covered with them and looks like a green field. In these masses are

many aquatic plants, but, beyond some pretty yellow *Utricularias* and the *Eichornia* which we have mentioned, we have noticed nothing with bright flowers. The cattle owners put out in canoes and capture these great grass islands and thus obtain a large amount of fodder. Sometimes one sees a big *Victoria regia*, its leaves all torn, rolling over and over in the turbid flood. It has come from some broad "*igaripe*" or inland lake, for the *Victoria* is never found in the main river.

We well remember our first sight of this noble plant in its wild state. Living in a little inland village, we had for weeks been planning an excursion to a large lake in the neighborhood where it abounds, and whence we had often received the great flowers, but, as one often puts off doing what he can do at any time, our trip had been delayed. One lovely morning, just about Christmas, we had paddled across the broad arm of the river to wander in the vast stretch of park-like "*varzea*," which lies between the parana-miri Juruty and the main Amazon, and which, in fact, is a great island. It was early; the sun was slanting amid the great trees and everything seemed green and gold; bright butterflies flew all around, or a great night morpho, with beautifully marbled wings, disturbed in his sleep in the recess of some huge buttressed tree, took a short flight to the shade of another. Birds were singing; great green beetles basked in the sun on the great white trunks of the Munguba trees (*Cecropia*), and the whole world had just awoke into life. We were familiar with the region, but our tramps had hitherto been north and west; we now turned to the east. After a time we saw an irregular belt of large trees, which evidently were on the shore

of a lake, and heard the hoarse bark of the lontras, an otter-like animal, who had already become aware of our approach. Drawing nearer we saw them in the middle of a little lake, plunging up and down, uttering their short bark, showing their white teeth in their anger at being disturbed. The water of the lake was low and the banks projected over it. Reaching the lake we lay down and looked over, and just below in a little bay was a plant of *Victoria regia*. It was not large, we have seen thousands larger, but it was as perfect a little specimen as one could wish. Five dark leaves, perhaps two feet in diameter, with the upturned rim and one great white flower already beginning to close in the sunlight. We were far away from any house; probably there was not a human being within five miles, but that flower was better company than anything else could be. How long we lay there we never knew, but it was until the *Victoria* wholly closed to a prickly bud. Never more would that pure white flower open; at sunset it would again expand, but it would be a delicate rosy pink, and again on the third day, but then a deep red and then it would bury itself to perfect its seed. Since then we have often seen the *Victoria*; we have under the light of the full moon seen hundreds, perhaps thousands, of flowers of all the three colors expanding as the sun set; we have crashed our canoe ruthlessly through acres of the great leaves, but that first sight will ever live as one of the pleasantest memories of our Amazonian life. Voyaging by night we would often put an opening bud of the *Victoria* in a great calabash and place it in the bow of the canoe to enjoy the rich fragrance, as it floated to us with the motion of the boat, as we lay under the *tolda* in the stern.

The perfume of the *Victoria* is not continuous, but is given off in puffs; one moment the flower is scentless, but soon comes a puff of fragrance which, if one is too near, is almost suffocating, for it is very powerful and fully inhaled



THE WATER HYACINTH—(*Eichornia speciosa*.)

makes one's head spin round merrily. The seeds of the *Victoria* are ground, or rather pounded, into a fine flour by the Indians and makes not unpalatable bread.

One would suppose that the Amazon would furnish many species of *Nymphaeas* or Water Lilies, but such is not the case. There is one, *Nymphaea ampla*, which is very common; there are acres upon acres in the flats; it is a coarse grower with large, dark, reddish green leaves, and flowers of medium size, varying in color from white to yellowish. It is a most disappointing species, for, though the flowers are handsome and have a rich Pineapple fragrance, one must sit up all night with them to smell it, or see the Lilies in perfection, for the flowers do not expand until very late and close in the very early morning, long before daylight. We had seen thousands of buds before ever we saw an expanded flower.

The flowers stand out of the water like the other tropical species. It is so large a grower that the plant would soon fill any pond, to the exclusion of every thing else. It is plentiful around Para, being often seen in the roadside ditches.

In Curtis' Botanical Magazine a beautiful little yellow *Nymphaea* is figured under the name of *Nymphaea Amazonica*, but we have never been able to see or hear of such a plant and doubt its existence. Possibly it may be the Mexican species, or even that of Florida, with a misnomer. There is, however, we believe, on the far river Purus, an immense *Nymphaea* with golden yellow flowers, for so many have told us of it, that we cannot doubt the fact. Once a steamer captain brought it for us. Arriving late at night, he put the plants in a tub of water in his yard to be sent to us in the morning. Unfortunately his wife kept ducks and when, on receiving his message to come for the plant, we arrived at his house we found that the ducks, who are very early



PONTERDERIA CORDATA—(Native of North America.)

risers, had destroyed every vestige of our Lily. In time we shall again receive it, but nothing in Brazil is ever hurried and the first lesson one has to learn is "*patiencia*."

Eichornia speciosa, the old *Pontederia crassipes*, which is now much cultivated

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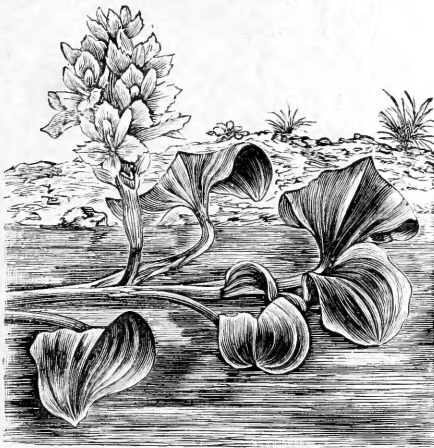
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under the not inappropriate name of Water Hyacinth, is a very beautiful plant. On the Amazon it covers acres with its showy flowers. While the plant is floating, the petioles are curiously swollen, but this regularity disappears when the plant becomes rooted. Once we found a white flowered variety, and several times we have seen plants with pink flowers. Unfortunately these occasions were always when we were far from home on some long excursion, and the plants were lost before we could get



THE WATER ORCHID—(*Eichornia azurea*.)

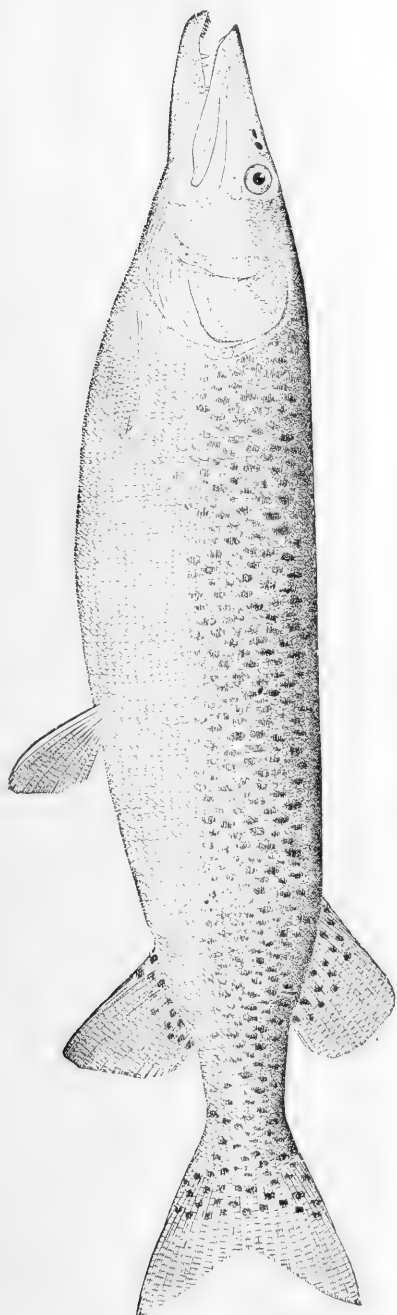
them where they could be properly cared for. The other species, *Eichornia azurea*, also a very pretty plant, is not Amazonian.

Some of the Utricularias have very bright yellow flowers, and we have seen reaches of marsh a mass of color. The Water Lettuce, *Pistia stratioides*, is a very common plant. It is handsome

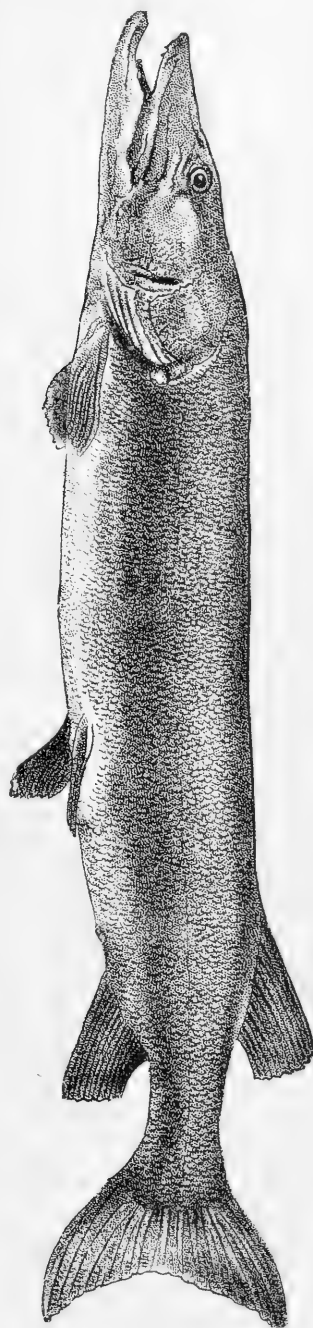
and interesting. It propagates so rapidly that a single plant will soon cover a very large area. The flowers are white, sessile and small, in a little spathe at the base of the leaves, each spathe containing one male and one female flower. This plant is the favorite food of the "*pixe-bois*," the Manitee or sea cow which lives upon the long roots. This animal is not uncommon on the Middle and Upper Amazon and is much sought, for its flesh makes an excellent dinner; it is white with streaks of green fat, very tender and tastes like chicken. Boiled in the oil it forms "*mixira*," which, when fresh, is a very nice provision for a long voyage, but Heaven help the man who has to live on old "*mixira*," hard as iron and of a rancidity which has no comparison, as we once had to do.

Salvinia brasiliensis, a very pretty little plant, often seen in aquariums, is very common. There is a species of *Pontederia* which closely resembles the common United States species, which in some places forms large masses; it is very common round Para. The flower is in appearance just like the North American plant, only not quite as handsome. There are doubtless many undiscovered aquatics on the Amazon. We have described a few of the most common. During our voyaging we did not give this class of plants especial attention, and at our house we had no facilities for their culture. They are difficult to transport, for, if found in the lakes it is no easy matter to keep them alive during a homeward tramp, which may last for days, and even in a canoe voyage they suffer much. In a future paper we may describe some of the smaller species which are worth growing.—EDWARD S. RAND, Brazil, in *The Mayflower*.

THE MUSKALLUNGE OF THE GREAT LAKES



THE MUSKALLUNGE OF THE UPPER MISSISSIPPI.



THE IRIS.

Of all the fairy tales and fables of Ancient Mythology, perhaps the most interesting is the story of Juno, the Mythical Queen of Heaven, surrounding the world with a transparent mist, which, pierced by the glittering rays of the Sun, produced the Rainbow, the archetype of *Iris*. Ancient Mythology, however, goes still further and tells us that Juno was attended by five deities and fourteen nymphs, but her most faithful attendant was *Iris*. But the age of fable is passed, and now we interpret the ancient ideas of the Rainbow, as



IRIS SUSIANA.

the embodiment of all that is beautiful or *divinely fair*, and a fit companion for the gods, of which they knew not, still, worshiped.

So much for the ancient origin of the name, while its application to the group of plants under consideration, is equally instructive. It was chosen by the early naturalist,—while the study of botany as a science was yet unknown,—to designate an indefinite section or group of plants, with especial reference to the *Iris*; all of which produce more or less brilliant and showy flowers, and all of which are unsurpassed for garden culture, especially, since the species and varieties now offered present such varied

forms and well contrasted colors. Linnaeus, in his effort to obliterate all the old botanical names, called the family *Ensate*, from the Latin *Ensis*—a sword—on account of their leaves being long, narrow and pointed, *i. e.*, sword-like. He, however, soon abandoned his name, and restored the old Greek name, *Iris*, which has been retained by subsequent botanists. In heraldry, the flower of the *Iris*, under the name of *Fleur-de-lis*, (pronounced by a corruption of the French language, *Flower-de-luce*,) was also employed as the royal emblem of France during the reign of the old Kings, consisting (in heraldry) of three flowers on an azure field. Its interpretation is “The Royal (purple) Lily, queen of flowers, the true representative of Majesty.” Since the establishment of the Republics, as well as during the Empires of France, the *Fleur-de-lis* has ceased to be used as the national emblem; but in some of its modified forms, it figures very conspicuously in the heraldic emblems of some of the oldest noble families of both France and England.

From a scientific point of view, or, more correctly speaking, in the natural order of the vegetable kingdom, the *Iris* approaches nearer the structure of the true Lily, than any other aquatic plant, for which reason, if for no other, we feel justified in treating of it as a Water Lily. But we know the propriety of calling it Water Lily will at once be questioned by many, and we must add a word more in explanation, for, although some species are the exact reverse of an aquatic plant, still some of our American and European species are so much at home on the low, wet margins of lakes and rivers, and are even often found growing in shallow water, where the roots, and sometimes the

crown of the plant, is often submerged during a large portion of the year, that we see no impropriety in adding the *Iris* to the list of so-called Water Lilies; particularly, as we propose to treat only of the American and European forms in this article.

Before we proceed further with this very common plant, let us abandon the idea of its being too commonplace and insignificant, to be worth devoting much time to, for of all *common* plants, of which this is often considered the least attractive, probably no one is so little understood, even by amateur cultivators as this family of plants. Its flower is so very complicated, that very few, except botanists, really understand its structure, or at least we find quite a difference in the descriptions published by different authors and writers.

By a reference to standard works on Botany, we find the *Iris* distributed over the entire world, from the far north, to the southern points of land in South America and New Zealand; but, in its manner of growth, we find it assumes an entirely different character, in different portions of the world. For example:—In the hot and dry regions, instead of a creeping rhizoma, as with us, it concentrates all its vitality into a bulb or corm, which remains dormant during the prevalence of the drouth, but develops again into activity at the approach of the rainy season. These, of course, are not aquatic plants, and will not come under our present consideration. In America we have, at least, eight well defined species, usually found in shallow water or swamps, but occasionally found in quite dry ground, and presenting the strange analogy of producing flowers of that unusual combination of colors,—yellow and blue,—two colors seldom found in the same

flower, or even in the same genus. Indeed, we have often seen the statement in print, that in no genus of plants can two natural species, or even varieties be found, one with a yellow and the other with a blue flower; but this is certainly a mistake, for numerous genera of plants contain one species with yellow, and another one with blue flowers; the examples of which may be cited, are *Crocus*, *Linum*, *Nymphaea*, etc. It is not, however, an usual combination of colors, and as some species of the *Iris* produce flowers with both colors in the same flower, adds an additional charm to their study.



IRIS GERMANICA.

Let us now examine the particular points of interest in our chosen subject for consideration. First, the portion of the plant commonly called the root, is, in this case, nothing more nor less than a prostrate stem, to which botanists have applied the name rhizome, which are, usually, only partly covered with earth, but sending down into the ground numerous small rootlets to supply the plant with nourishment. These prostrate stems and rhizomes in the *Iris* consist of a bundle of coarse and fibrous tissues, thickened with a large store of nutriment, in the form of farinaceous and saccharine matter, well calculated to feed a luxuriant growth of foliage,

especially in early spring ; and, also, to induce new buds or shoots to break out at the side of the old rhizome, and form a large clump or cluster, but which, in time, separates into distinct plants. These, like the stock of a hardy shrub, remain dormant through the winter, or, in the language of botany, are perennial, and are usually seen in short, knotty sections, representing its period of growth.

The leaves of the *Iris* are very little understood, except by botanists, for in place of one surface facing up (towards the sky) and the other down (towards the ground) as is usual, or one surface facing the right and the other the left, as in some of the *Acacias*, etc.; in the *Iris* the leaf is linear, or sword-shaped, and erect ; but "each leaf is formed and folded together lengthwise, so that what would be the upper surface is within, and all grown together except next the bottom, where each leaf covers the next younger one. It was from their straddling over each other, like a man on horseback, that Linnæus, with his lively fancy, called these equitant leaves."—*Gray's Lessons*.

The flowers are erect, usually from a spathaceous bract of two or more leaves, produced, usually, singly in succession, each one opening but once. They are fertilized by the aid of insects.

The *Iris*, although not contributing directly to the support of the human family, except in a limited sense, has added its *mite* towards the comforts and luxuries, usually of semi-civilized people in different portions of the world. The tuberous or bulbous rhizomas contain, in addition to the saccharine matter, a small portion of a fatty and acrid matter, together with a peculiar volatile oil which gives them stimulating properties. Some species lose their acridity

by drying or boiling, and are then used as food, especially by the Hottentots, of South Africa, where it is called *oenkjes*, and has nearly the same taste as our potato. In its growing state, no animal will eat the leaves except goats, but when cut and dried like hay, cattle will quite readily eat it. The roots, however, are quite extensively utilized in different portions of the world. The



YELLOW FLAG—(*Iris pseudacorus*.)

old and well known violet perfume, "Orris Root," is the product of the beautiful white-flowered species, *Iris florentina*, which was also at one time quite extensively used in flavoring or toning liquors. The blue perinth of *Iris Germanica*, crushed and mixed with lime, yields the "Iris Green" of painters. Finally the seed of *Iris pseudacorus* are a well known substitute for

coffee.—(*Hooker.*) The roots of some species, especially *Iris psued-acorus*, are used very extensively in preparing black dyes and ink.

Like most of our native semi-aquatic plants, it thrives in any common garden or mucky soil, requiring no especial attention; but it should remain undisturbed for a number of years, and then will bloom quite freely. The two English varieties, *Iris psued-acorus* and *I. fœtidissima*, emit a disagreeable, fetid odor, not found in our American species to any considerable extent. The dwarf Siberian *Iris*, *I. Siberica*, and the Austrian *Iris*, *I. Pumila*, with their many various colored flowers, form excellent border plants; and as they are so very hardy, in a few years they make a complete mat of green foliage, and carry out the object of a border line to perfection. Within the past few years, botanical travelers and collectors have secured an almost endless variety of these choice plants, from the far off and little known countries; and now our English cousins, especially, can boast of a collection that vie with any other class of hardy plants in the world, for beauty and well contrasted colors; while to say that some of the species are perfectly gorgeous, only indifferently describes their beauty. Of course our American plant buyers will never think of utilizing any of our native species, but we hope the day is not far distant when we shall see this beautiful family of plants more generally grown, especially when our nurserymen advertise more carefully and generally the new foreign varieties. European landscape gardeners make great use of even the most common varieties of *Iris* in their lawn decorations, especially in their planting by lake and river margins, where the effect is all that can be de-

sired. But the old world landscape gardening is on more of an elaborate and gorgeous scale than anything in America, consequently we see very little of this perfected art or science to copy from except near a few of our large cities, where the art has been applied to the beautifying of cemeteries and parks.

FERNS.

The cultivation of ferns for the decoration of our homes has, of late, become so general that all are more or less interested in learning what is the most successful mode of managing them. The object of green and hot houses is to regulate the degree of light, heat and moisture requisite for the growth of plants: in other words, to imitate their native climate.

But how can this be done without such aid? The question is, how to succeed in encouraging the growth, and developing and preserving the beauty of these exotics, and making them feel at home in the windows of our living rooms. It can be done with a little care. The four essentials, light, heat, and moisture in a proper degree, and an appropriate soil can be furnished in an ordinary living room, and many beautiful species of ferns can be grown from the spore to maturity, and the reward will be more than ample for the trouble. Before speaking of their cultivation, let us take a glance at the nature, habits and habitats of the plants themselves. What is a fern? Leaving out all botanical terms and niceties, a fern may be described, in a popular way, as a plant which bears leaves only, and no flowers, distinguished from other plants not in flower by bearing its seed (called spores) upon the under surface or along the

margins of its leaves. These spores are seen as brown dust like patches, round, oval or in lines. They are arranged with great regularity, and upon their arrangement, form and covering, botanists base their division and classification into the different genera and species. The development of a fern leaf also differs from that of most other plants: in the bud it is usually rolled up from the point to the base. To this rule, however, there are some exceptions. There are two hundred genera and two thousand species of ferns described by botanists. Of the species there are many varieties depending upon differences of climate, soil and other causes. These varieties also are constantly increasing in number by hybridization under cultivation in green and hot houses. They are distributed over the whole surface of the earth, from the equator to the cold regions of the north and south, and always flourish best, whether in temperate or tropical zones, in moist, shady places.

The stems of this plant are usually creeping, but sometimes, as in the case of the tree ferns of the tropics, they are erect. The creeping stems are underground and the leaves or fronds are the only part of the plant which shows above the surface. In height they vary from two inches, and even less, to a few feet; but the tree ferns of the tropics often attain an altitude of fifty feet and even much more. Indeed, they are said to rival the majestic palms.

We will say nothing about the botanical divisions of ferns, but, for the purposes of this paper, will divide them only into two great classes, the *Deciduous* and *Evergreen*. They first develop their fronds, mature the spores, and, upon the approach of frost, the foliage dies, and the stem and roots lie dormant

in the ground until the next season of growth. The evergreen ferns throw up their fronds and there they remain bright and green until their successors appear. In the tropics, of course they continue to grow during the winter months, only approaching a condition of rest during the dry season. Under protection, with moisture and heat supplied, they grow luxuriantly during the whole year. The evergreen ferns of the colder climate do not, of course, continue their growth during the winter season, but the fronds remain erect and preserve their fresh, bright green color until the new ones appear in the spring. It is with the evergreen ferns that we have most to do, as they will serve to cheer us in the winter when all of the deciduous ones are asleep out of sight. Many of the deciduous ferns will grow very well in pots, and make very pretty summer ornaments, but the most favorable conditions of heat and moisture will not coax them to make a winter growth. If you have, during your summer excursions, brought home and potted a collection of these beauties, you need not be discouraged when you see them wither and die upon the approach of winter. Put them away in some place just warm enough to keep the pots from being broken and destroyed by frequent freezing and thawing. Do not let them get too dry and they will renew their beauty in the spring and gladden you all summer.

But it is best to confine yourself to the evergreen ones for cultivation, and the list to select from is indeed a long one. You can get young plants from the florist, or, if you choose to take the time and trouble you may grow them from the spores. This is the natural way in which ferns are propagated just as flowering plants are grown from seed.

All true seeds have a determinate structure; they contain, folded up within them the embryo, with all the special organs in a rudimentary state, of the plants which they are destined to produce; the germ of the descending axis, (called the radicle) which forms the root, and the germ of the ascending axis, (called the plumule) which forms the stem. No matter in what position the seed is placed in the soil, this already prepared radicle always develops downwards and the plumule upwards. Not so with fern spores; these have no determinate parts; a spore is only a minute vesicle containing one or more cells. When the spore is placed on a damp surface the cells absorb moisture, swell and divide into a number of similar cells which unite. This process is repeated until a minute round or oval green leaf, not at all like a characteristic fern leaf is formed. This is called the primordial scale. Next, the point of this leaf which happens to be in closest contact with the soil becomes thicker by a further division and union of its cells, and from this thickened point the roots develop and strike into the soil. Last of all the frond appears and the minute plant is perfect in all its parts. If you wish to grow a stock of seedling ferns, you can get the spores from a seedsman or gather them yourself from the plants of your friends. Take off a portion from a frond with ripe spores, which you will easily recognize by their brown or blackish color. You only want a small portion of the frond, for thousands of the spores are contained in each of the patches. Wrap this piece of leaf in a smooth white paper, (the spores would adhere to rough paper) and allow it to become perfectly dry, when you can crumble it with the fingers and the spores will fall on the

paper as fine brown dust. While crumbling it, hold your fingers near the paper or a great many of the spores will float away in the air and be lost.

Now take a pot of any convenient size and, after putting drainage in the bottom, fill it up to within one inch of the rim with any light, loamy soil that is free from insects and weed seeds. In order to destroy any such intruders as may be in the soil, it should be well baked in the oven or scalded with hot water before sowing the spores. Press the soil down in the pot so that it will be firm and level, then thoroughly moisten it and scatter the spores evenly and thinly over the surface. Set the pot in a saucer filled with wet sand or moss, and cover it with a piece of glass, or, better still, with a bell-glass or jar, to prevent evaporation and secure constant and uniform moisture. Place the pot in a shady place in the room where it will not be disturbed, at a north window is the best. Light, however, is not essential until after germination has taken place, then it is needed to develop the fronds. This can be done at any season of the year. If in winter, it should be in a room where the temperature does not at any time fall below 50° F. in the night, and rises to 65° and 70° in the daytime. A higher temperature is needed for the more tender varieties, and will hasten the growth of the hardy ones. If it is done in the spring, say in April or May, the growth is sooner and perhaps more certain, the hardier varieties coming up first, and the more tender ones following as the days become warmer.

When necessary to give water, do not pour or even sprinkle it upon the surface, as that would certainly wash out and destroy many of the plants and spores, but hold the pot in a vessel of

water until thoroughly moistened from below.

In a few weeks the surface of the soil will assume a green, mossy appearance, and if you examine this with a glass, you will see the minute round or oval leaves, (the primordial scales,) whose forms a few more days will reveal to the naked eye. You will be much interested in watching the development of the little fronds which soon follow. Be patient, give plenty of light but no sunshine, keep the soil uniformly moist, and in good time you will have a fine stock of little plants. When these are large enough to handle, they must be picked out and planted singly in the smallest sized pots. Some varieties may be left in the seed pots even a year before transplanting.

(*To be continued.*)

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In due recognition of the fact that it requires time and also money to inquire into the causes of diseases of goldfish, several gentlemen in Germany, and also the editor of *THE AQUARIUM*, are now making up a purse of one thousand (1,000) marks to be given to the person discovering the causes and cures of certain new diseases of goldfish kept in aquariums.

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MR. W.—The weight of the water will bend the zinc or galvanized iron bottom of an aquarium if the latter is not supported by a wooden one, and thus cause the cement to give way. In your case we would use a lot of old newspapers; put these on the table first to the required thickness and then set the tank on it. An aquarium tank should not be carried with water in it.

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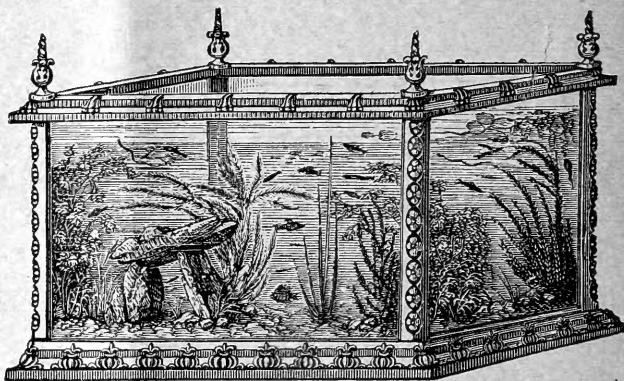
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